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Our changing climate

Trends, extremes, attribution and projections

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Observations and attribution

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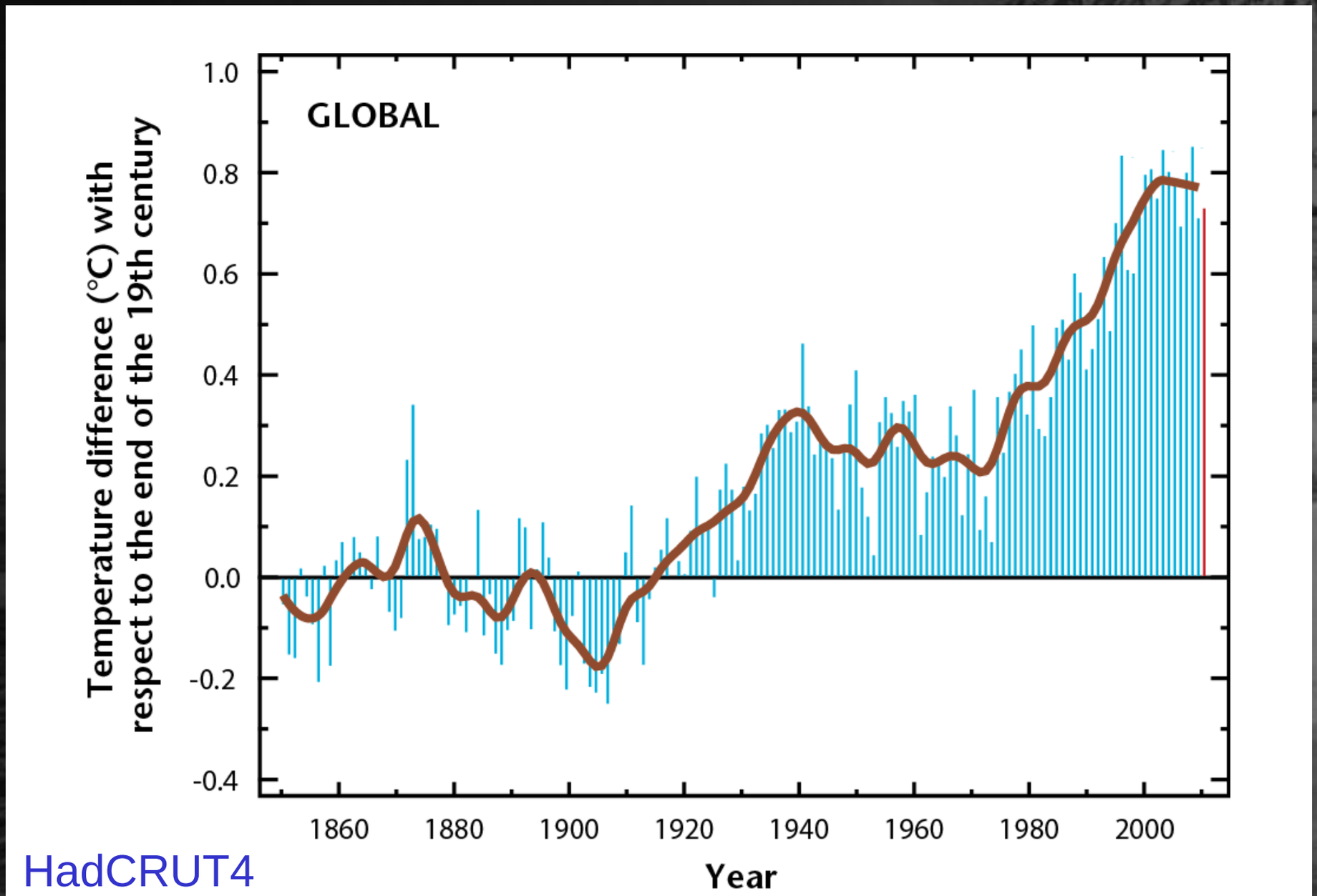
Global near-surface temperature shows a long-term warming trend



HadCRUT4

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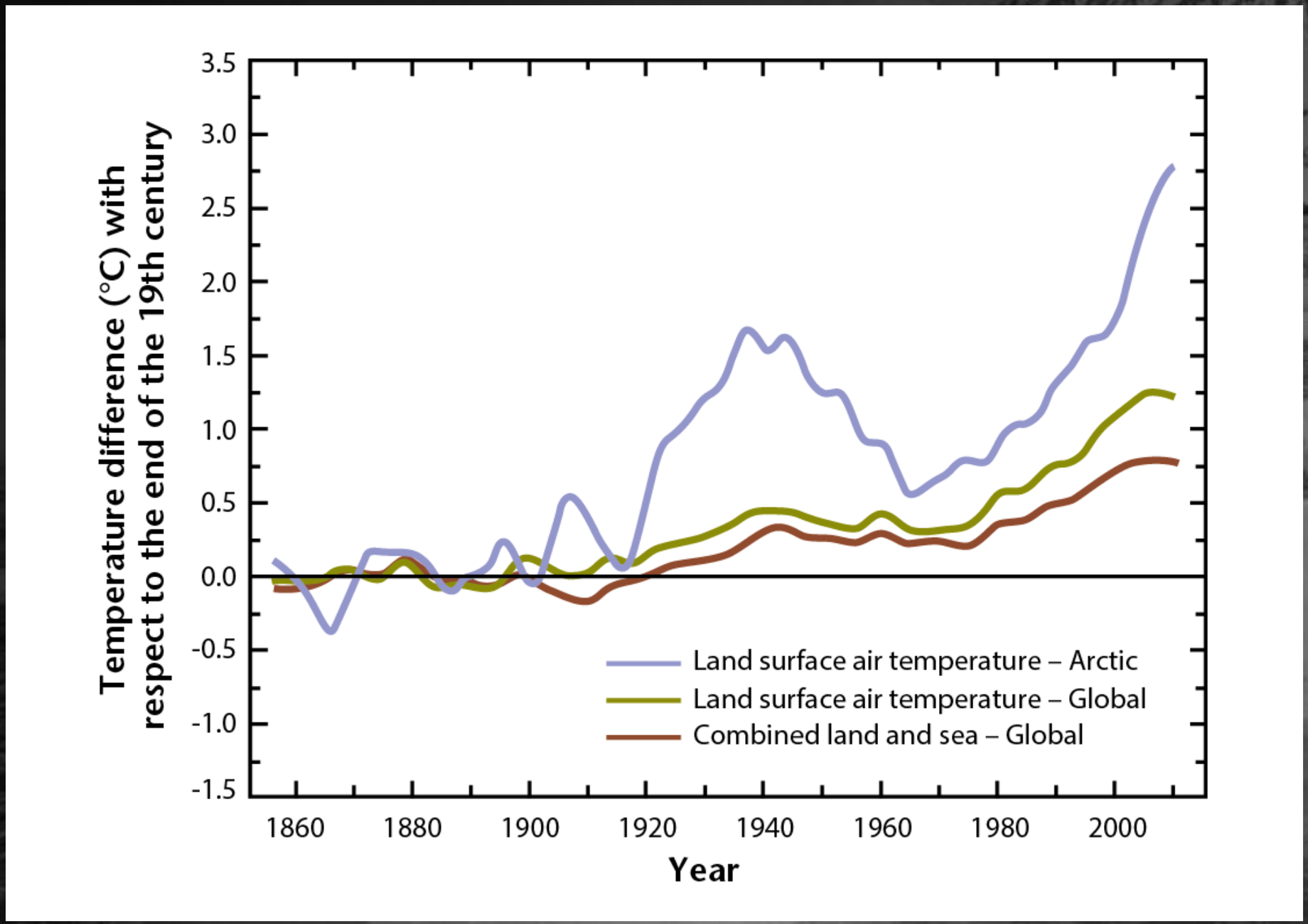
Air temperature over land has risen faster than over the sea



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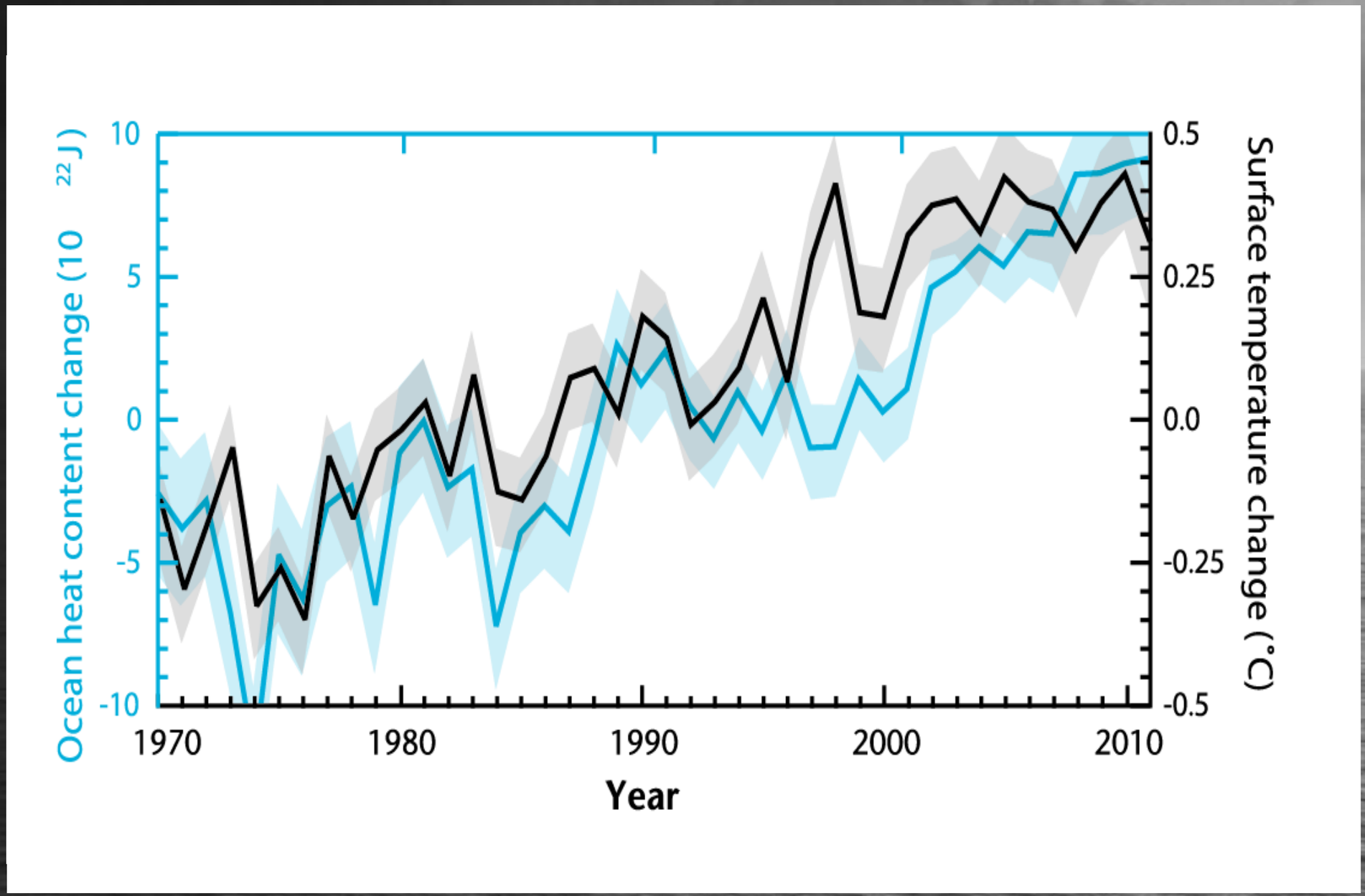
More than 90% of the extra heat goes into the ocean



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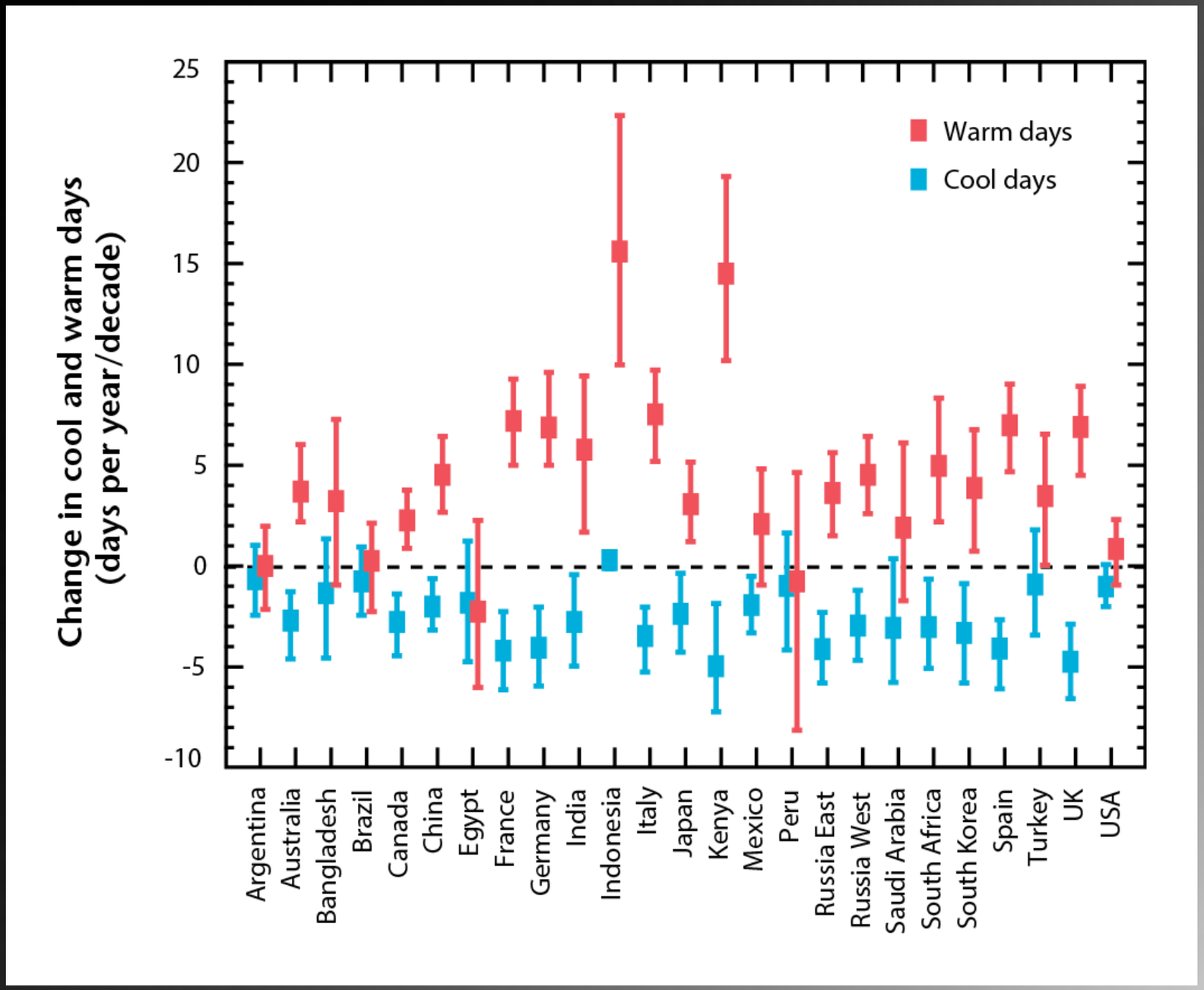
Daytime and night time temperature extremes have changed



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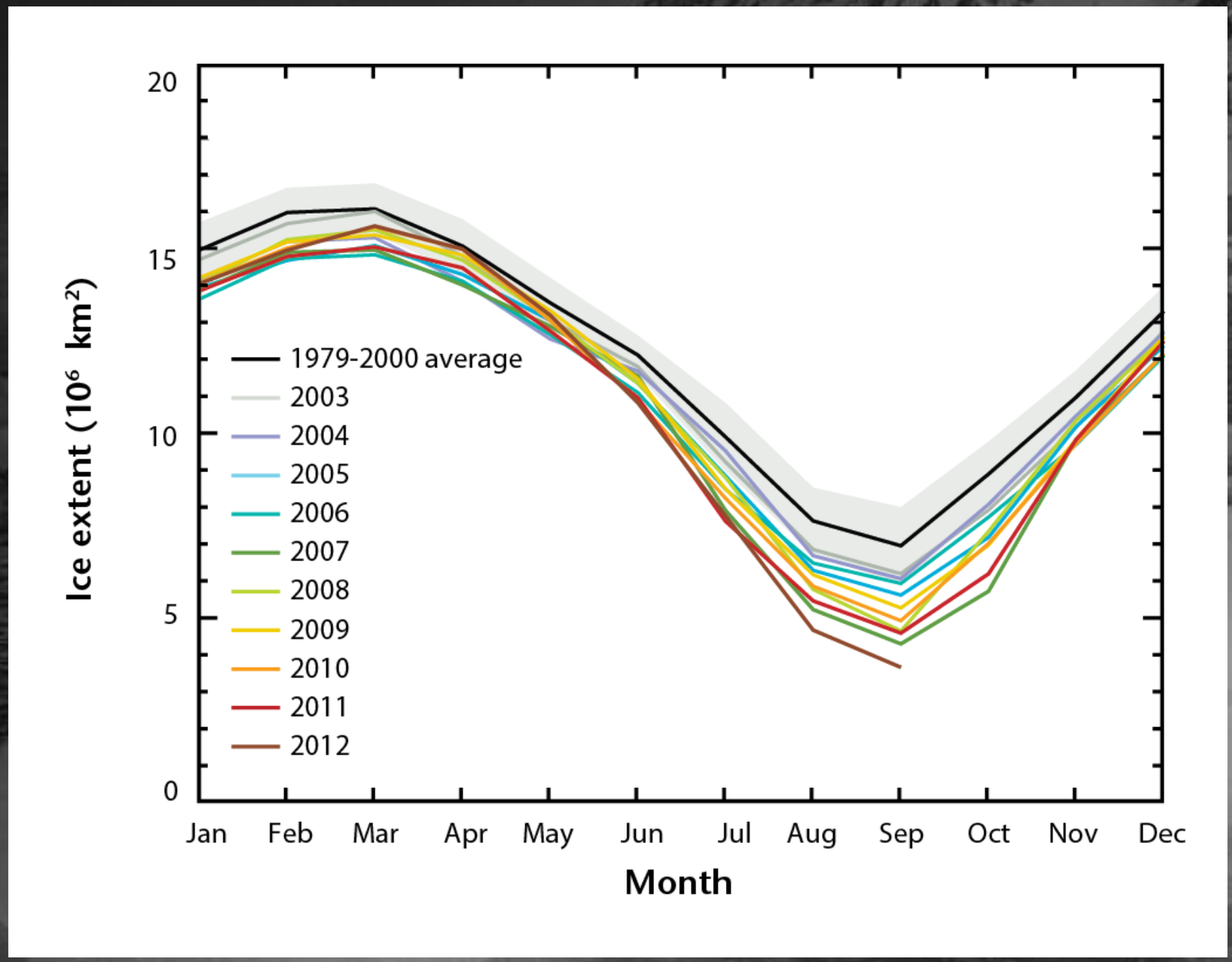
Summer Arctic sea ice extent continues to decline

- Arctic sea ice has declined 4% per decade during satellite period
- The rate of summer ice loss has increased over last 15 years
- Since 2003 magnitude of seasonal cycle has moved outside internal variability – especially in summer



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During the summer large parts of the Arctic are now ice free

- Extent of summer Arctic sea ice reached record low of 3.41 million km^2
- Previous record of 4.17 million km^2 surpassed on 26 August

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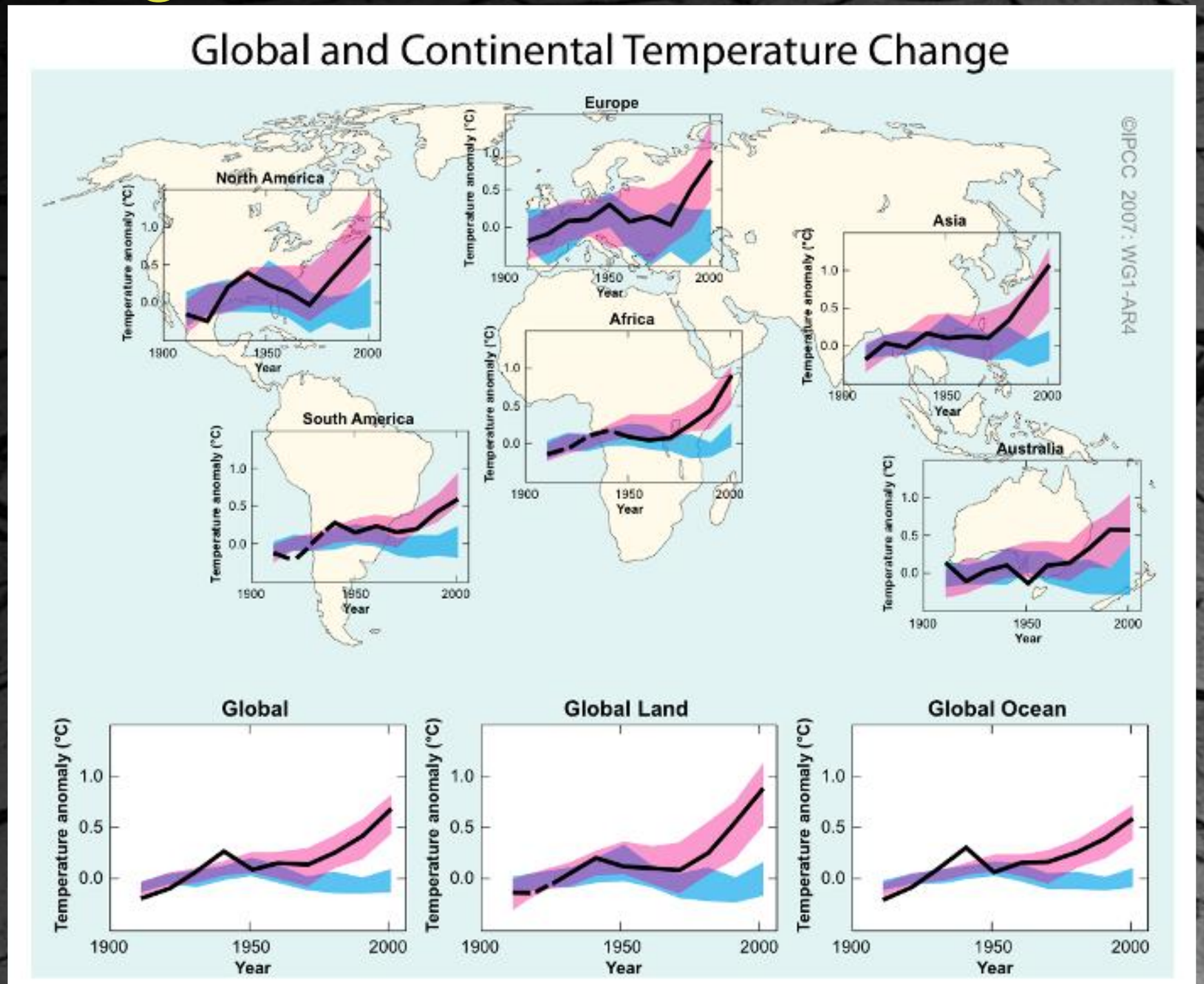
Earlier results have shown evidence of a human fingerprint in warming trends

Black
Observations

Pink
simulated response to anthropogenic and natural forcings

Blue
simulated response to only natural forcing



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Human influences have changed the odds of some extreme weather events

EVENT IN 2011	HAVE HUMANS CHANGED THE ODDS OF OCCURRENCE?	COMMENTS
Texas heatwave	Increased	During La Niña years only
Unusually warm November in UK	Increased	About 60 times more likely than during the 1960s
East African drought	Inconclusive	Both La Niña and humans could have increased the odds
Cold December 2010 and January 2011 in UK	Decreased	Natural variability could still result in cold winters
Thailand floods	Insufficient evidence	Factors other than climate change at play
Warm European spring and autumn	Increased	Takes into account weather patterns

The Met Office Hadley Centre, along with colleagues in the US National Oceanic and Atmospheric Administration, trialled the attribution of recent extreme weather in the Bulletin of the American Meteorological Society (BAMS) in July 2012. Attribution studies on six extreme weather events of 2011 were presented.*

* Peterson, T.C., Stott, P. A., Herring, S. (Eds) 2012. *Explaining Extreme Events of 2011 from a Climate Perspective*. BAMS. 10.1175/BAMS-D-12-00021.1

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Earth system projections

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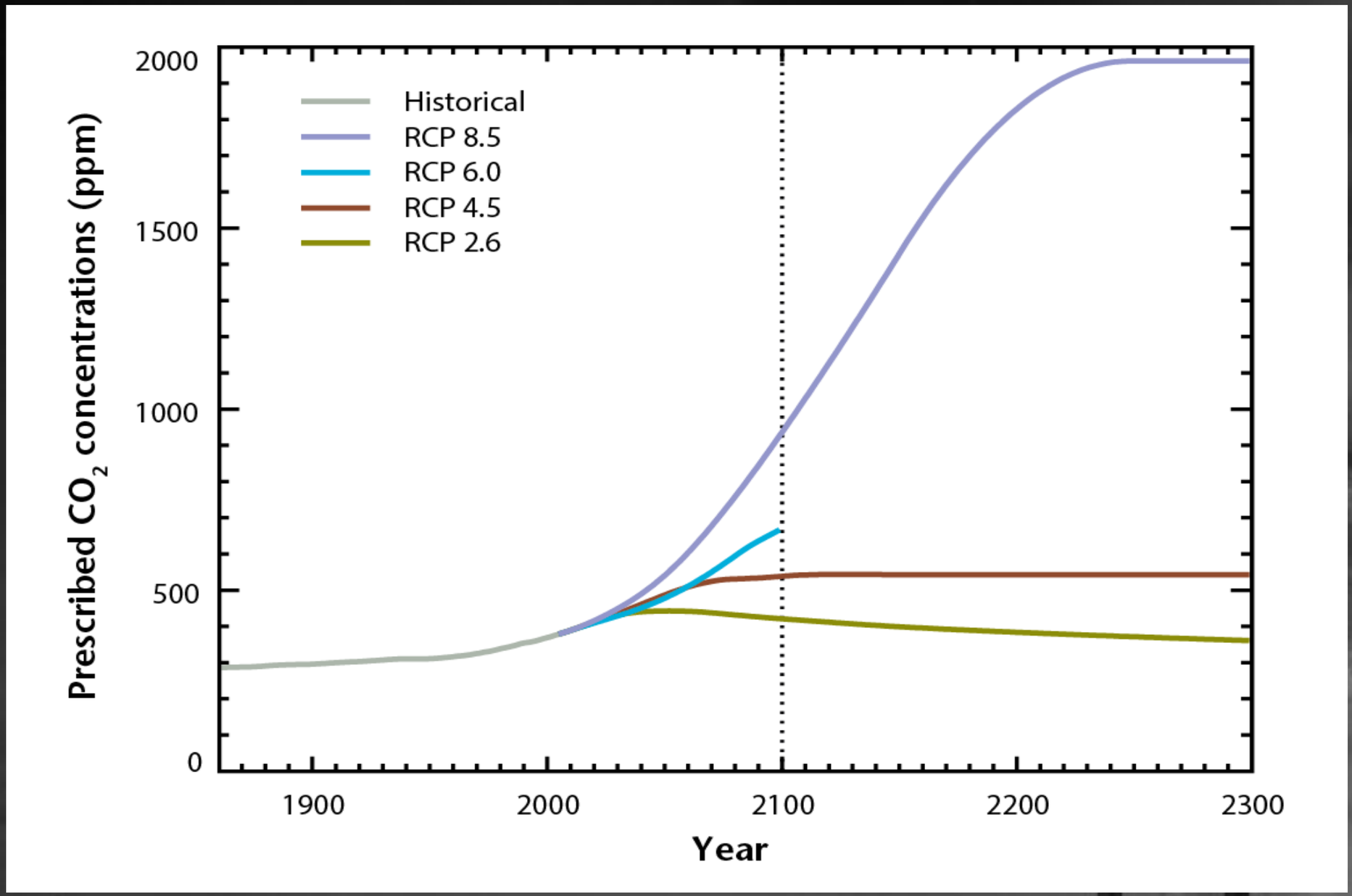
Long simulations of an earth system model have been produced for several future greenhouse gas pathways



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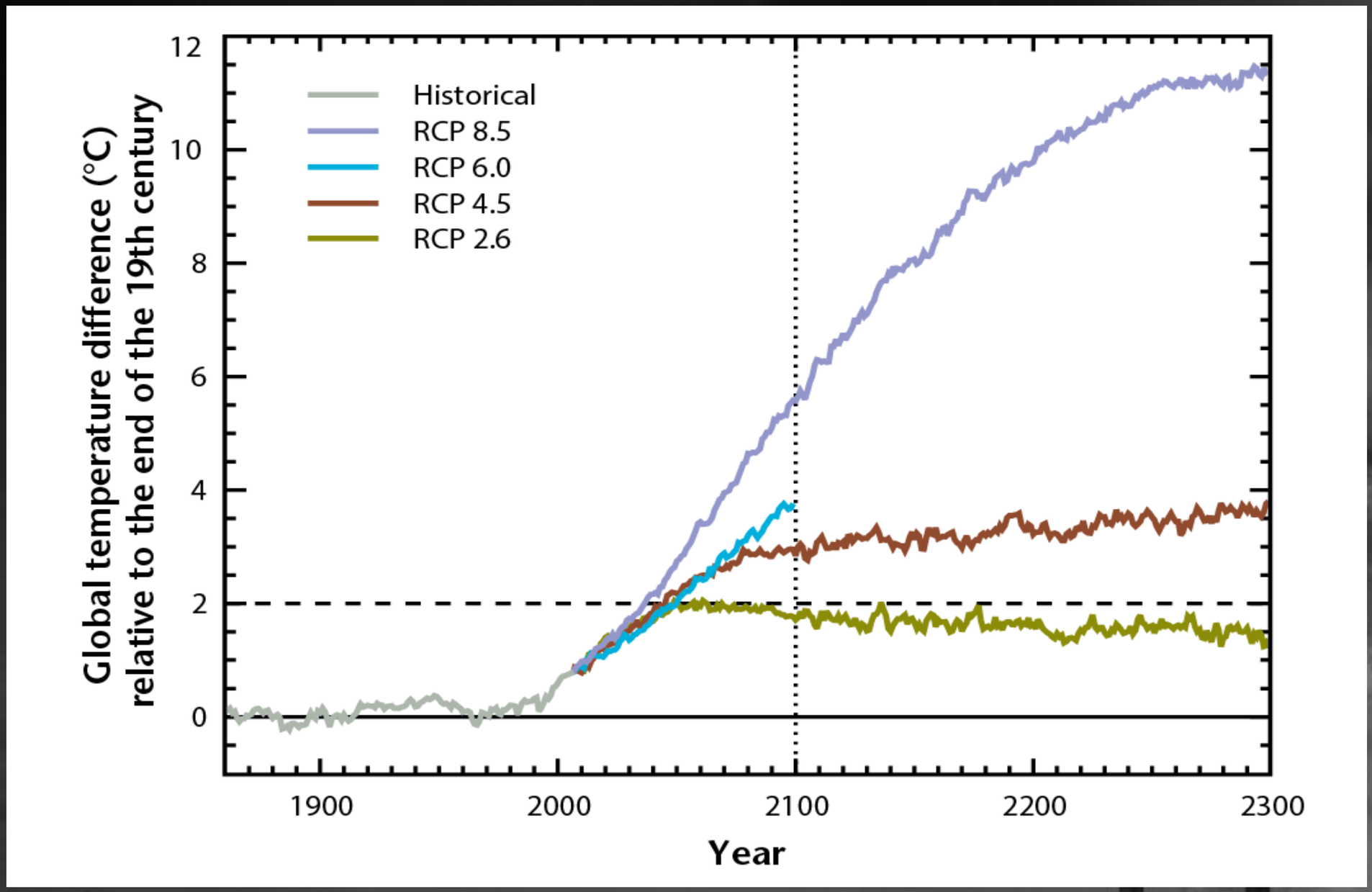
Global temperature is projected to rise in all the pathways



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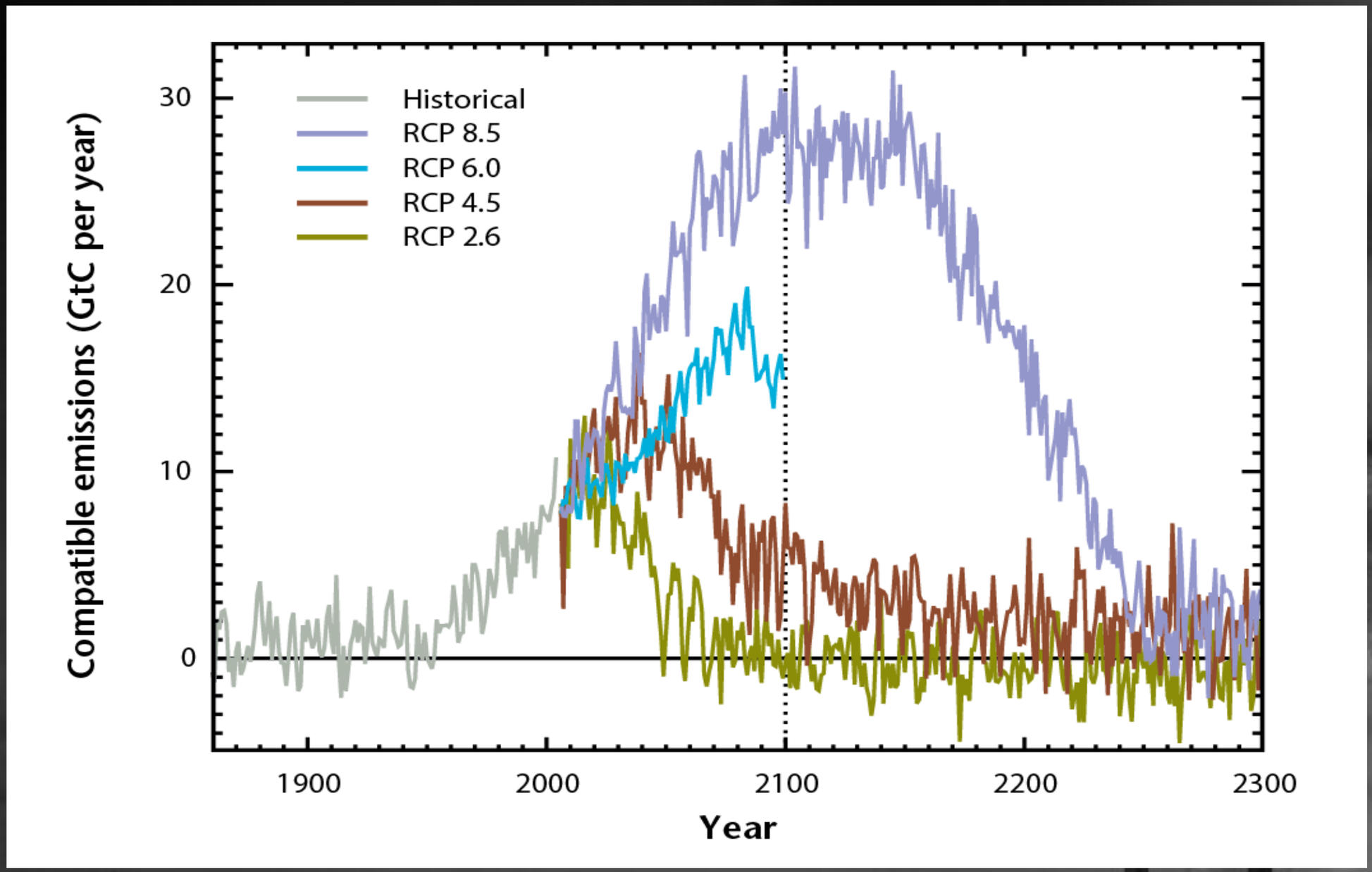
The lowest RCP scenario requires large and rapid reductions in emissions



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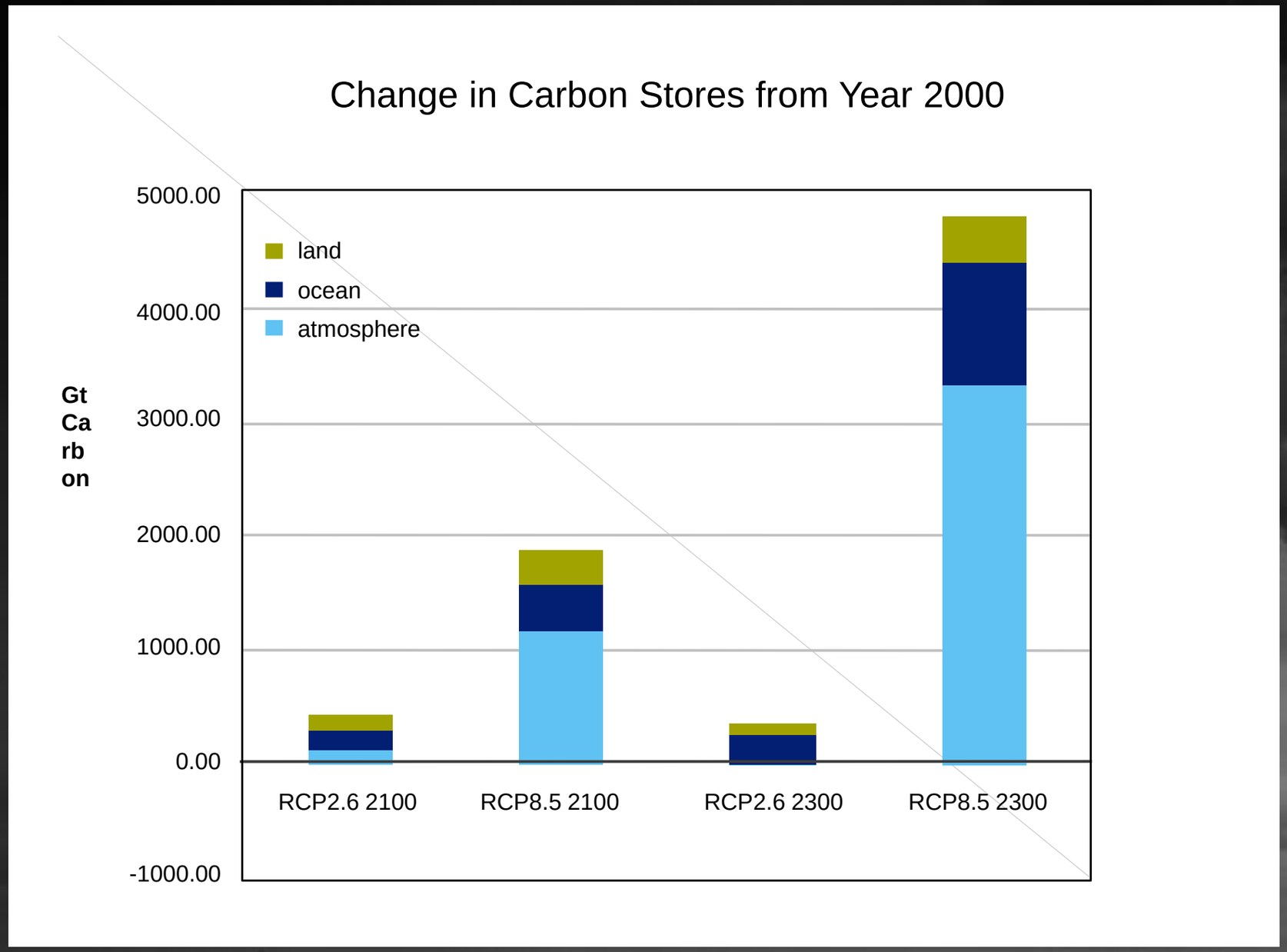
Where do the anthropogenic carbon emissions go?



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Other parts of the earth system are also changing

Temperature extremes
Warm days rise by between 80 and 240 days by the end of the century.

Arctic sea ice
Continued declines expected.
Arctic ice free in summer by as early as 2025-2030, although could be later.
Loss may impact on European weather.

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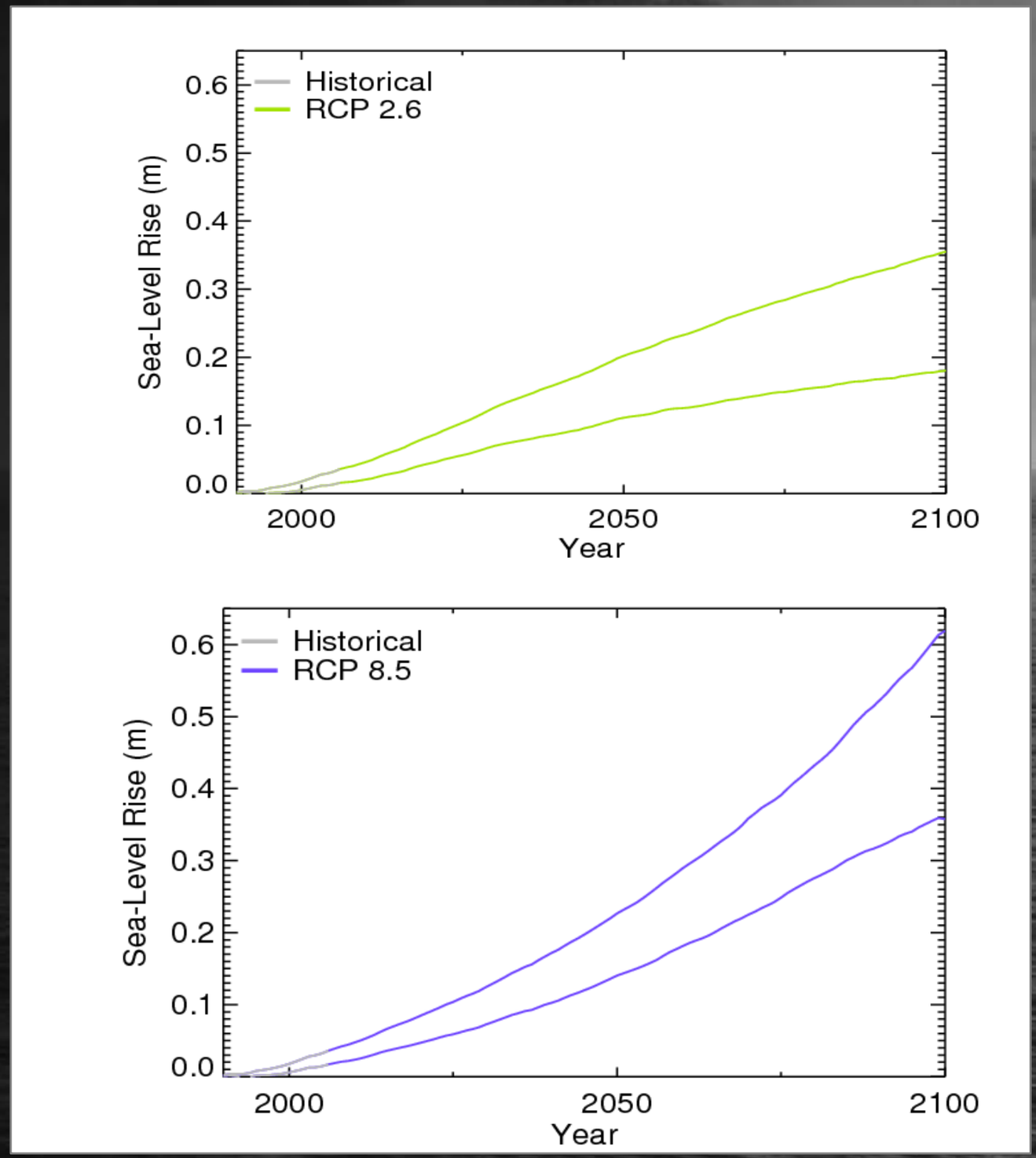
Other parts of the earth system are also changing

Sea level is expected to rise further from both thermal expansion and land ice melt

Uncertainty in ice sheet dynamics remains large



Other parts of the earth system are also changing

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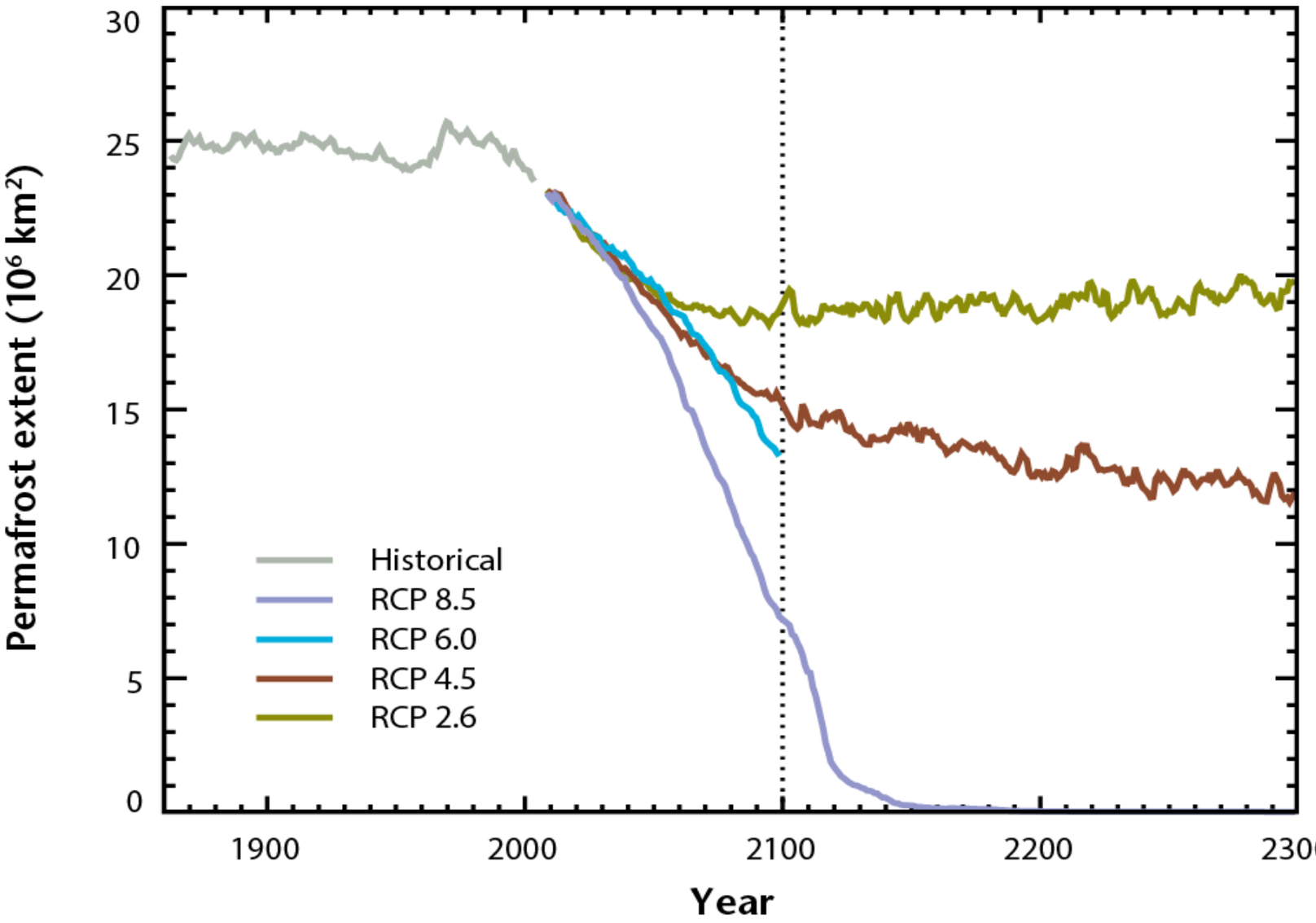
Simulated Permafrost Extent



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Key findings

- Year 2012 is likely to be the 9th warmest on record, 0.04°C above the 2011 value.

- Many other observed changes are consistent with our understanding of the earth system and include loss of Arctic sea ice, increase in ocean heat content, increase in number of warm days, and decrease in number of cold days.

- Attribution studies show how the odds of some types of extreme events have been changed by anthropogenic influences.

- Earth system models show further changes in the future, including continued warming, further loss of sea ice and land ice, and loss of permafrost. Even a 2°C world will see many climate system changes.

- To be consistent with a 2°C warming limit requires significant reductions in greenhouse gas emissions.

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Thank you

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